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THE RELATION BETWEEN YIELDS AND PRICES

BY E. DAVENPORT

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The State Bankers Association has furnished the Experiment Station, thru the different banks, with a list of names of progressive farmers of the state, and has asked that publications of special interest be sent to their addresses from time to time. Responsive to this request this circular is issued and is being sent not only to the names furnished by the Bankers Association but also to the regular mailing list of the Experiment Station. If parties to whom this circular is sent care to receive the regular publications of the Experiment Station and will notify the Director to that effect, their names will be added to the regular mailing list.

This circular is issued to call attention to certain financial aspects frequently overlooked in discussions pertaining to an improved agriculture. It is designed to be studied rather than hastily read.

THE RELATION BETWEEN YIELDS AND PRICES

BY E. DAVENPORT, Director

INTRODUCTION

The following points are generally assumed without argument by writers and speakers discussing agriculture :

1. That large yields are always profitable and that the best farmer is the one who raises the most per acre.

2. That large yields are a natural antidote for the high cost of living.

3. That when prices are low the farmer should raise his yields to protect his income.

4. That everybody is suffering because of the "slipshod and wasteful methods of the American farmer."

5. That we should now copy the intensive methods of older countries and that more capital is needed for the best results.

As a matter of fact, there is truth in all these propositions, but it is mixed with an amount of error and of misconception concerning the economic laws governing agricultural production that is dangerous both to the farmer and to the consumer.

CHEAP FOOD AND LOW YIELDS

We are just emerging from a pioneer agriculture, in which land had little value, because it was abundant, and labor was the principal element in the cost of production. If the American farmer has been wasteful of fertility it is because he has had it to waste, but he has been exceedingly economical of labor, which was costly, and has produced the cheapest food the world has ever eaten, or ever will eat, tho the yields per acre have been little more than half those of older countries. Our question has been not how much *per acre* but how much *per man*, and in this the American farmer has been right even tho his average yields have been low.

We are, however, approaching old-country conditions. Land is growing scarce, and therefore costly, so that elements other than

labor have begun to enter into the cost of production and food is necessarily higher.

Under pioneer conditions the highest yields have been the most profitable because they were the result, not of expensive methods of farming, but of especially rich spots of land or of favorable seasons, costing nothing extra beyond the increased expense of harvesting. It is still true that high yields are profitable *if they can be cheaply produced, but the general principle is that the higher the yield the greater the cost, not only per acre, but per bushel.*

This natural operation of the economic law of diminishing returns in farming is best illustrated by an experiment begun many years ago by Lawes and Gilbert at Rothamsted, England, the oldest experiment station in the world. They applied, every year for twelve years, different amounts of complete fertilizer to adjoining fields of wheat, with the following results:

Fertilizer applied ¹	Av. 12 yrs.	Increase	Increase per 200 lbs.
None	18.4 bu.		
200 lbs.	28.4 bu.	10.0 bu.	10.0 bu.
400 lbs.	36.4 bu.	18.0 bu.	8.0 bu.
600 lbs.	38.0 bu.	19.6 bu.	1.6 bu.

By this we see (fourth column) that as an average of the twelve years the first 200 pounds of fertilizer returned 10 bushels, but that a second 200 pounds increased the yield only 8 bushels above the first, and that a third 200 pounds returned but a little over a bushel and a half above the double dose, showing that increased outlay is not always followed by correspondingly increased yields.

The experiment was continued, and at the end of fifty-two years the results were as follows:

Fertilizer applied ¹	Av. 52 yrs.	Increase	Increase per 200 lbs.
None	14.8 bu.		
200 lbs.	23.9 bu.	9.1 bu.	9.1 bu.
400 lbs.	32.8 bu.	18.0 bu.	8.9 bu.
600 lbs.	37.1 bu.	22.3 bu.	4.3 bu.

These figures for half a century show the same principle of diminishing returns in a modified form. Due to soil exhaustion, the

¹Nitrogenous fertilizer with abundance of mixed minerals.

yields from the unfertilized land decreased during the fifty-two years. On account of a few bad seasons, the average effect of the first dose (200 pounds) was slightly decreased. Owing to the accumulation of residues of fertilizer, the effects of the second and third doses were relatively larger than for the twelve-year period, tho subject to the same law of diminishing returns. That is to say, the last dose of fertilizer was less than half as effective as the first; or, what is the same thing, the last increment of increase cost more than twice as much per bushel as the first.

PRICES AND YIELD

In the more intensified agriculture that is just ahead of us, the question is, therefore, not how much the farmer can produce per acre, but how much he can *afford* to produce. His yield must depend, not mainly upon his knowledge of production, but *upon the price of the product*.

For example, in the tables quoted, each 200 pounds of fertilizer cost \$7.50. With wheat at a dollar a bushel, a little computation will show that both the single and the double applications would pay, but that the triple application would swallow all the profits and more. At eighty cents a bushel, only the first dose would make money; while at fifty cents a bushel, none of the treatments would pay, and both the farmer and the public would have to be contented with the lower yields from untreated land until such time as the consumer was willing to pay a higher price for his food. In this way is yield dependent upon price, and it is the natural way in which supply adjusts itself to demand as expressed in price.

Of the same tenor is the experience of the University, which is producing corn yields varying from 26 bushels per acre on continuously unfertilized land, to an average of 93 and a maximum of 120 bushels per acre on land which is excessively fertilized. It is making no money on either extreme: in the one, because the yield is not sufficient to pay the labor; in the other, because the fertilizers are so costly as to swallow all the profits. The problem of the farmer, therefore, is to determine at what point between these extreme yields he must aim to fix his average yield, and in determining this point he must take into consideration the value of his land, the cost of labor, the cost of fertilizer, and the probable price he will receive for his product.

From this we see the impossibility of "doubling yields without increased expense," and also that when prices drop, the income of even the best farmers must decline, for extreme yields are profitable only with high prices. It must be clear that we cannot recklessly increase the yield per acre.

On the other hand, we cannot continue the old-time wasteful methods of soil exhaustion, cheap and effective tho they were in their day, because they are resulting in decreasing yields in the face of increasing demands. If our declining yields, due to soil exhaustion, are to be arrested and turned into even a slight increase to meet the growing demands, it is clear that new methods must be employed, but the object must be a *moderate increase in yield by economic methods* and not extreme yields, which are bound to result in loss to the farmer or in prohibitive prices for food, or both.

Our farming is now in a transition stage between the "extensive agriculture" of the pioneer, in which fertility is disregarded and there is no investment but labor, and the "intensive agriculture" of old and densely populated countries, in which the main question is yield per acre, resulting either in high cost of food or in poorly paid labor. (China produces the most per acre but pays its laborers the least.)

Our present yields are below what the climate and the general situation ought to produce, owing mainly to certain adverse conditions that can be cheaply and easily corrected, and money put into this channel will well repay the investment *because it will increase the yield without being subject to the law of diminishing returns*. This is where our present duty and opportunity lie in establishing the foundations of a permanent agriculture. It must be remembered that *we have not yet reached the intensive stage, where it will pay either the producer or the consumer to attempt maximum yields on American land*.

RATIONAL PROCEDURE

In this transitional stage, in which our yields are kept down by certain adverse conditions, the first step in a rational procedure is the correction of these conditions by relatively inexpensive methods, such as the use of lime to correct acidity, the application of cheap forms of phosphorus or of potassium to balance fertility, keeping nitrogen always the limiting element, a better adjustment of crops to soil and

to locality, and the organization of more economic systems of farming, with special attention to live stock, the distribution of labor, and the investment of capital. All the advice given out by the University of Illinois at this juncture is based upon this principle, because investments of this character, whether of labor or of capital, are certain to increase the yield with relatively slight expense. Having done what we can in this way, we may await with confidence the intensive stage, the coming of which will be characterized by a permanent rise in prices.

THE HANDICAP OF THE SMALL FARMER

The greatest hazard in farming is the season, against which improved methods are only a partial protection. The farmer with little or no capital must confine himself to practices that will pay *every year*, while the man with considerable means is free to follow those more expensive methods which pay best in the long run, even tho an adverse season now and then might show a loss. This lack of capital cannot be remedied by short-time loans to the small farmer, nor by loans of any kind to the farmer whose yields are limited by bad cultivation or to the one incapable of managing his business upon the more complex and, to him, more dangerous basis that will be at once established when he attempts to increase his yield by a larger use of capital.

FARMING ON CREDIT

It is commonly said that not enough floating capital is invested upon American farms, and it is doubtless true, but it must be remembered, both in extending credit and in making loans, that the American farmer has had little experience in handling capital. Manifestly, therefore, when he borrows, both he and the lender must be satisfied that the loan will be judiciously used, or it may result disastrously.

The student of agriculture cannot fail to see the danger of overcapitalization in attempts to secure abnormally high yields, a danger which increases as the practice spreads, for altho one man may safely increase his yields without depressing the price, *if all farmers were to follow his example the price would drop and all would lose money.* Under this principle a few farmers will always be practicing methods not practicable for the mass. By this we see that *in the long run the chief results of better farming will be realized by the consumer rather*



than by the farmer. All attempts to hold production with the purpose of raising the price are as unavailing as they are unwarranted. The world wants food, and the principles herein presented are the ones that will guarantee its cheapest production.

CONCLUSION

It is relatively safe, therefore, to invest capital freely upon the farm for the sake of correcting abnormal conditions and raising the yield to the normal, but beyond that point it will pay only when prices rise. As we approach this point by reason of increased population with its increased demands, either the cost of food must rise or labor be greatly degraded, else the farmer cannot afford to produce the increase needed. As population increases, therefore, but one alternative will present itself—each human unit must become more efficient in production, or it must deny itself much of what is now enjoyed.

This circular is issued not as an argument for poor farming nor for the continuance of old-time methods, but to point out that we are not to step at once and blindly into expensive forms of intensive agriculture. We should ascertain and practice those relatively inexpensive methods belonging to a transition stage that correct bad conditions and thereby considerably increase the yield without seriously raising the price, so that the results may be profitable alike to the farmer and to the public whom he serves. In this good work there is no danger of doing too much.